MO-63

OPERATING MANUAL

3000 HP DIESEL ELECTRIC
ROAD FREIGHT LOCOMOTIVE

SPECIFICATION HR-616

Bombardier Inc.

Rail and Diesel Products Division

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3000 HP DIESEL ELECTRIC ROAD FREIGHT LOCOMOTIVE

SPECIFICATION HR-616

This manual covers basic operating instructions to assist operating personnel in the efficient handling of the HR-616 locomotive.

Information furnished is based on locomotive construction as of date of publication. Some minor differences between the locomotive and these instructions may be encountered because of refinements in specifications after the manual was published.

June 1982

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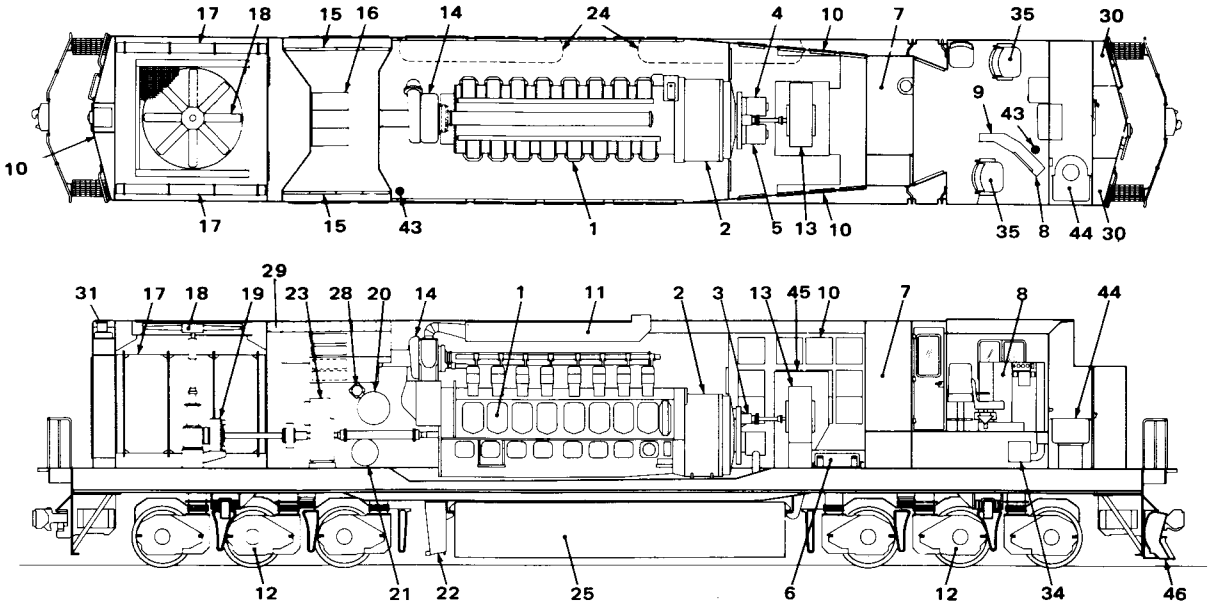


FIGURE 1
GENERAL ARRANGEMENT

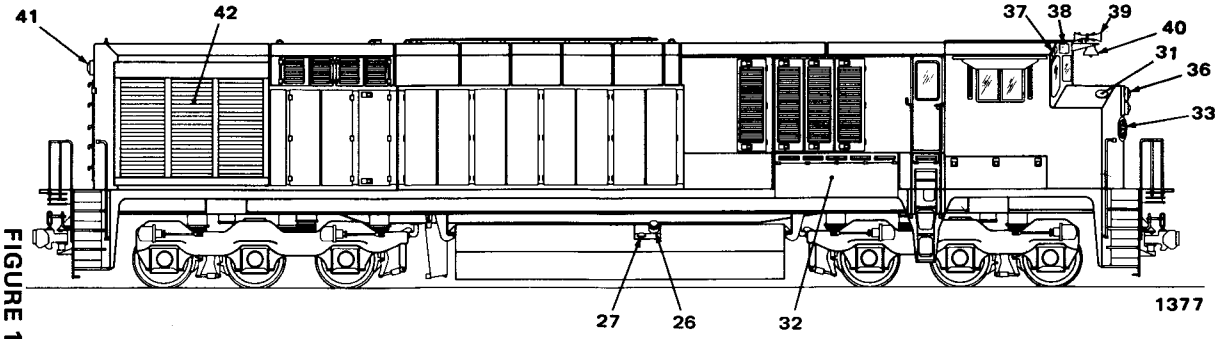


FIGURE 1
GENERAL ARRANGEMENT

1. Engine
2. Traction alternator
3. Gear unit, blower drive
4. Exciter
5. Auxiliary generator
6. Rectifiers
7. Control compartment
8. Control stand
9. Brake valves
10. Carbody filters
11. Silencer
12. Traction Motor
13. Traction motor blower
14. Turbocharger
15. Engine air filters - primary
16. Engine air filters - secondary
17. Radiator
18. Radiator fan
19. Radiator fan clutch
20. Lube oil filter
21. Lube oil cooler
22. Anti-pollution tank
23. Air compressor
24. Main air reservoirs (left side)
25. Fuel tank
26. Fuel tank filler
27. Fuel tank gauge
28. Fuel oil filter
29. Engine water expansion tank
30. Sandbox
31. Sandbox fill
32. Battery
33. Handbrake
34. Cab heater
35. Cab seat
36. Headlight
37. Class lights
38. Number box
39. Horn
40. Bell
41. Back-up light
42. Radiator shutters
43. Fire extinguisher
44. Toilet
45. Winterization box
46. Snow plough

DATA

General:

Model Number	HR-616
Class -AAR	B-B
Track Gauge	1 435 mm (56.5 in.)
Wheel Diameter	1 066.8 mm (42 in.)
Maximum Permissible Speed	104 km/h (65 mph)
Minimum Continuous Speed	18.9 km/h (11.8 mph)
Gear Ratio	65/18
Traction Motors	6
Air Brake Equipment	26-LUM

Engine:

Model	251
Traction Horsepower at 1000 rpm.	3000 BHP
Bore	228.6 mm (9 in.)
Stroke	266.7 mm (10-1/2 in.)
Cylinders	16V

Capacities:

Fuel Oil	16 362 L. (3600 Imp. Gals.)
Lubricating Oil	1 227 L. (270 imp. Gals.)
Cooling Water	1 636 L. (360 Imp. Gals.)
Sand	1.58 m^3 (56 ft^3)
Air Compressor Oil	39.75 L. (8.75 Imp. Gals.)
Generator Gear Case	2.27 L. (0.5 Imp. Gals.)
Governor	1.14 L. (0.25 Imp. Gals.)
Radiator Fan Gear Box	2.85 L. (0.625 Imp. Gals.)
Traction Motor Bearing Suspension	4.5 L. (1 Imp. Gal.)
Traction Motor Gear Case	5.4 kg. (12 lbs.)

Normal Pressures:

Main Air Reservoirs	793-862 kPa (115-125 psi)
Control Air Reservoir	483 kPa (70 psi)

SECTION 1

GENERAL DESCRIPTION

INTRODUCTION

The HR-616 is a 2238 kW (3000 BHP) diesel electric locomotive designed for road freight service. It consists of one unit complete with diesel engine, alternator, trucks and necessary accessories, with an operating cab at the front of a fully enclosed carbody. The carbody design permits access to the engine compartment and trailing units while in operation.

Throughout this Manual, the word "engine" refers only to the diesel engine. The words "unit" or "locomotive" refer to the vehicle as a whole.

In the case of two or more units being coupled together, the term "multiple unit" or M.U." will be used.

DIESEL ENGINE

Each locomotive is powered by a Vee-type, turbosupercharged, Model 251, four stroke cycle diesel engine having an open combustion chamber with direct injection. The engine is started by the auxiliary generators, acting as motors, using current from the battery. Engine speed is governed by an electro-hydraulic governor.

Full pressure lubrication of all parts is supplied by a gear-driven pump integral with the diesel engine. An automatic device is used to shut down the engine in the event of low oil pressure.

An electrically driven fuel pump is provided to supply fuel from the tank to the engine injection pumps.

A pressurized cooling system is used where the cooling water is circulated by an engine-driven centrifugal pump and flows successively through the engine, the radiator and the lubricating oil cooler. A thermostatically controlled fan, driven through an eddy current clutch, maintains engine operating temperature automatically.

TRACTION GENERATOR

The traction generator (alternator) is an alternating current, three-phase machine connected to the diesel engine crankshaft. Solid state rectifiers convert A.C. voltage to D.C. for application to the traction motors. The amount of electrical power developed is determined by the rotational speed of the armature and the field current supplied by the excitation system.

EXCITER AND AUXILIARY GENERATOR

The exciter and auxiliary D.C. generator are gear driven from the main generator shaft. The auxiliary generator supplies power for battery charging, control circuits, lighting and auxiliary motors. The exciter supplies power to the excitation system.

TRACTION MOTORS

Each D.C. motor is supported by axle suspension bearings and resilient nose supports mounted on the truck transom. A pinion gear, on the motor armature shaft, meshes with a drive gear on the wheel axle.

The forward and reverse movement of the locomotive is controlled by the positioning of the reverser which changes the direction of the current through the traction motor fields when the reverser handle, located at the operator's position, is moved from OFF to FORWARD or REVERSE position.

TRANSITION

The locomotive is equipped with automatic transition. Transition is the changing of traction motor connections which takes place automatically at predetermined locomotive speeds during acceleration and deceleration. The motor connections take place in reverse order when the locomotive is decelerating with power on.

AUXILIARY EQUIPMENT

Engine Air System

Air is drawn through panel filters and then through cartridge filters before passing to the turbocharger. Both filters are the disposable glass fibre type.

Electrical Rotating Equipment

Air is drawn into the generator and blower compartments through disposable, glass fibre, panel type filters. The air is drawn in by the action of the traction motor blower and the ventilating fan in the traction alternator.

Cooling air drawn through the traction alternator discharges into the engine compartment. The compartment is pressurized to prevent infiltration of airborne dirt from outside the locomotive. This air is exhausted through openings in the engine hood.

The air drawn by the traction motor blower is ducted principally to cool the traction motors. Part of this air is used to cool the auxiliary generators, the rectifiers and to pressurize the electrical control compartment. A small volume of air is also fed to the cab heating and ventilating system.

Auxiliary Drives

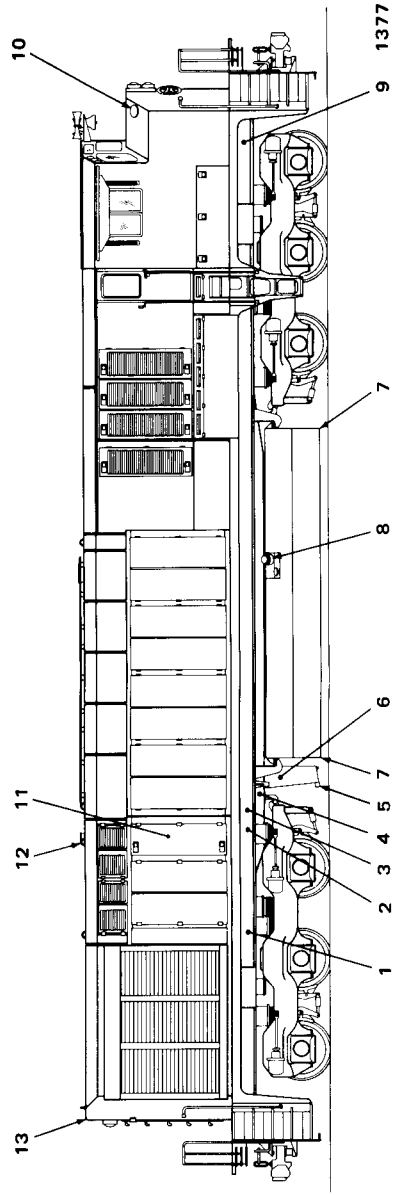
The diesel engine drives the compressor via a flexible

coupling and the radiator fan through an eddy current clutch and a right angle gearbox. The traction motor blower is driven via a flexible coupling from the alternator gearbox.

SAFETY EQUIPMENT

A safety control system is provided. It is operational whenever the locomotive brakes are released. The system is designed to initiate a penalty brake application, after an audible warning, unless appropriate action is taken.

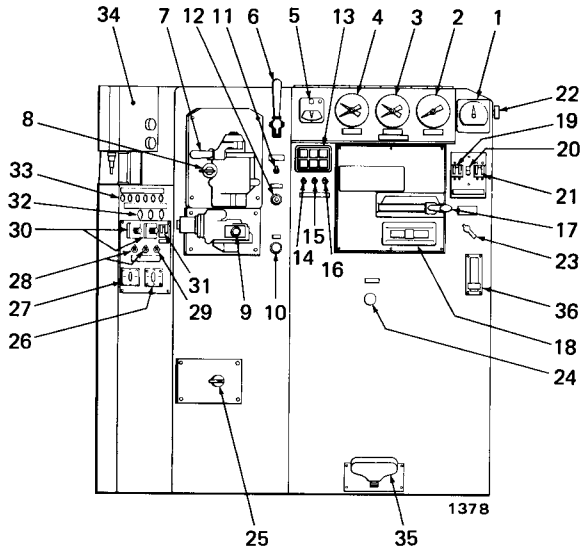
Speed, engine systems and train safety are monitored by an automatic monitoring system. Malfunctions are indicated by warning lights in the cab.



1. Air compressor crankcase drain - Far side
2. Engine water drain - Far side
3. Water expansion tank vent and overflow - Far side
4. Engine oil drain - Near side
5. Pollution tank drain - Centre line
6. Pollution tank steam clean connection - Far side
7. Fuel oil drain - Centre line
8. Fuel oil fill - Both sides
9. Toilet drain - Near side
10. Sandbox fill - Front, 2 openings
11. Engine water fill - Far side, in hood
12. Water expansion tank gravity fill - Centre line
13. Sandbox fill - Rear, on centre line.

FIGURE 1 - 1

FILLERS AND DRAINS LOCATION



1. Loadmeter
2. Booster air gauge
3. Duplex air gauge
   Red - Brake cylinder
   White - Brake pipe
4. Duplex air gauge
   Red - Main reservoir
   White - Equalizing reservoir
5. Brake pipe flow meter
6. Horn valve
7. Automatic brake valve
8. Brake valve cutout valve
9. Independent brake valve
10. Bell operating valve
11. Lead axle sanding switch
12. Sanding switch
13. Annunciator panel
14. Ground light switch
15. Walkway light switch
16. Gauge light switch
17. Throttle handle
18. Reverser handle
19. Main control circuit breaker
20. Generator field switch
21. Engine control circuit breaker
22. Loadmeter dimmer
23. Front headlight switch
24. Gauge light rheostat
25. MU2A valve
26. Ditch light switch
27. Cab heater switch
28. Step light switches
29. Back-up light switch
30. Classification lights switches
31. Radio circuit breaker
32. Headlight and back-up light indicaters
33. Warning lights
34. Radio control head
35. Deadman's pedal
36. R.S. heater duct damper lever

FIGURE 2 - 1
CONTROL STAND

SECTION 2

OPERATING CONTROLS

The principal operating controls are described in this section, other controls and features are self-explanatory or are described in other sections of this manual.

CONTROL STAND (Fig. 2-1)

Controller Operating Handles

Throttle Handle

The throttle handle, which controls the engine speed, has an IDLE position, eight running notches and a SHUTDOWN position.

When the handle is moved to the SHUTDOWN position, all engines in a consist are shut down. The SHUTDOWN position is for emergency use only.

Reverser Handle

The reverser handle determines the direction of locomotive movement and has three positions, FORWARD, OFF, REVERSE.

Mechanical Interlocking between Handles

Throttle Handle - can be moved from IDLE position only with the reverser handle installed.

The throttle handle must be pulled outward to move from IDLE to SHUTDOWN position.

Reverser Handle - can be installed or removed only in OFF position, throttle handle in IDLE.

The reverser handle can be moved only when throttle handle is in IDLE or SHUTDOWN.

Brake Valve Handles (Fig. 3-1)

Refer to SECTION 3, AIR EQUIPMENT.

Loadmeter

The loadmeter is a colour band meter used as a guide to proper locomotive operation. The pointer shows the current of one traction motor and therefore indicates the relative amount of tractive effort. The green zone represents normal motoring operation. In this zone, operating time is unrestricted. The red zone indicates short time capacity (overload) of the traction motors. The point at which the colour band changes from green to red indicates the end of the continuous rating.

Short Time Load Operation

The overload range has been graduated to show the time, in minutes, that various loads may be carried. The greater the load, the shorter the time allowed with maximum time as indicated. If the pointer remains between any two numbers, the maximum time allowed must be estimated by the operator.

If the load changes, the operator must judge when the full allowable time in the overload zone has been used up. For example: if only half the time was used at one load before it changed, the allowable time at the new load would be one half of its indicated time. When the short time load has been used for the full allowable time, the load must be reduced until the pointer is at or below the red line in the green zone.

CAUTION: The load must be held at or below the red line for at least 20 minutes before another overload

may be repeated. If this practice is not followed, the traction motors may be seriously damaged.

Loadmeter Light Dimmer

Controls the intensity of the loadmeter lighting.

Booster Air Gauge

Indicates turbocharger discharge air pressure. The gauge should show approximately 25 psi with full throttle and engine loaded.

Air System Gauges

Air gauges are provided to indicate main reservoir air pressure and various pressures in the air brake system.

Brake Pipe Flow Indicator

Indicates the rate of flow of air into the brake pipe during charging. When the automatic brake valve is placed to RELEASE, the light on the indicator remains illuminated until the brake pipe is adequately charged.

Lead Axle Sanding Switch

Controls manual sanding of the front axle only. A light illuminates in conjunction with the actuation of the sanding switch, indicating that the switch is energized and front axle sanding is in effect.

Sanding Switch

A wobble stick provides a means of initiating manual sanding independently of the automatic system. Manual sanding is trainlined to all units in a consist.

Warning Lights and Annunciator Panel

Refer to SECTION 4, AUTOMATIC ALARMS AND SAFEGUARDS.

Ground Light Switch

Controls the ground lights.

Walkway Lights Switch

Controls the front and rear walkway lights.

Gauge Light Switch

Controls the control stand gauge lights.

Headlight Switch

The switch has three positionss, OFF, DIM, BRIGHT, operation of the headlights is monitored by indicating lights located on the control stand. In M.U. operation, the switch is operated in conjunction with the M.U. headlight set-up switch.

Main Control Circuit Breaker

Protects the positive side of the control circuits.

NOTE: The negative side of the control circuits are protected by breaker MCBX, which should be left on at all time.

Generator Field Cutout Switch

Places excitation on the traction alternator. When the switch is open, no tractive power can be generated.

Engine Control Circuit Breaker

Energizes the positive side of the engine speed circuit, i.e. the throttle and governor.

NOTE: The negative side of the engine control circuits are protected by breaker ECBX; which should be left on at all time.

Gauge Light Rheostat

Controls gauge light intensity.

Ditch Lights Switch

Controls the operation of the ditch lights (if used).

Radio Circuit Breaker

Protects the radio circuits.

Cab Heater Switch

Controls the operation of the cab heating system (Refer to "Cab Heating System.")

Step Light Switches

Controls the front and rear step lights.

Back-up Light Switch

Controls the rear headlight. In M.U. operation, switch is operated in conjunction with the M.U. head light set-up switch.

Classification Light Switches

Each switch has four positions identified by coloured segments. The top left hand corner is OFF, the three remaining segments correspond to the class light colours. Each segment should light to monitor the operation of the selected class light. Class lights are provided at the front of the locomotive only.

Two Way Radio

The radio comprises a control head, mounted on the control stand, and a communication unit and mounting base, located in the left side compartment of the short hood. The control head contains the volume and channel selector controls.

Heater Duct Control Lever

Controls the air flow in the cab right side heating duct. The left side heating duct control lever is located on the cab left front wall.

SWITCH AND CIRCUIT BREAKER PANEL (Fig. 2-2)

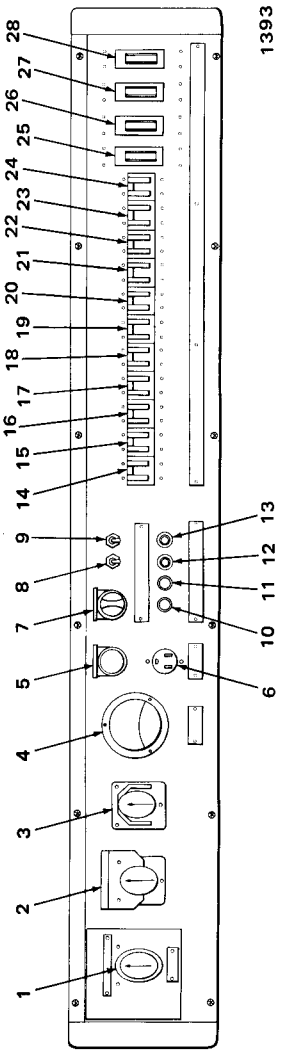
Traction Motor Cutout Switch

Has several positions to cut out selected pairs of motors as indicated on the switch plate.

The throttle or the engine control switch must be in IDLE before operating the motor cutout switch. Power of the unit is automatically restricted when motors are cut out. In the event that the ground relay trips, the motor cutout switch may be used to some advantage in determining the location of the fault.

M.U. Headlight Setup Switch

Has five positions. Place switch in proper position according to unit's location and direction in train.



1. Traction motor cutout switch
2. M.U. Headlight setup switch
3. Engine control switch
4. Battery ammeter
5. Emergency fuel shutoff and engine stop button
6. Receptacle, 75 VDC
7. Engine room lights switch
8. Compartment lights switch
9. Number lights switch (front)
10. Water cooler fuse
11. Bell ringer heater fuse
12. Low water warning light
13. Excitation field off warning light
14. Main control negative circuit breaker (MCBX)
15. Engine control negative circuit breaker (ECBX)
16. Headlights circuit breaker
17. Auxiliary generator field circuit breaker
18. Window heater circuit breaker
19. Hot plate circuit breaker
20. Lighting and auxiliary No. 1 circuit breaker
21. Lighting and auxiliary No. 2 circuit breaker
22. Fan control circuit breaker
23. Fuel pump circuit breaker
24. Crankcase exhauster circuit breaker
25. Cab heater negative circuit breaker
26. Cab heater positive circuit breaker
27. Battery negative circuit breaker
28. Battery positive circuit breaker

FIGURE 2 - 2
SWITCH AND CIRCUIT BREAKER PANEL

Engine Control Switch

Has two positions, IDLE and RUN. With the switch in the IDLE position, the engine speed is held at idle and load cannot be applied to the traction generator (alternator). The switch must be in IDLE to start the engine.

The switch is moved to RUN in order to operate the engine above the idle speed.

Battery Ammeter

Indicates battery charging or discharging current. It should show a charge, however small, whenever the engine is running.

Emergency Fuel Cutoff and Engine Stop Button

Pressing the button will stop the engine, regardless of the position of other controls.

Light Switches

ON - OFF switches control lights as marked on the panel. Operate switches as required.

Fuses

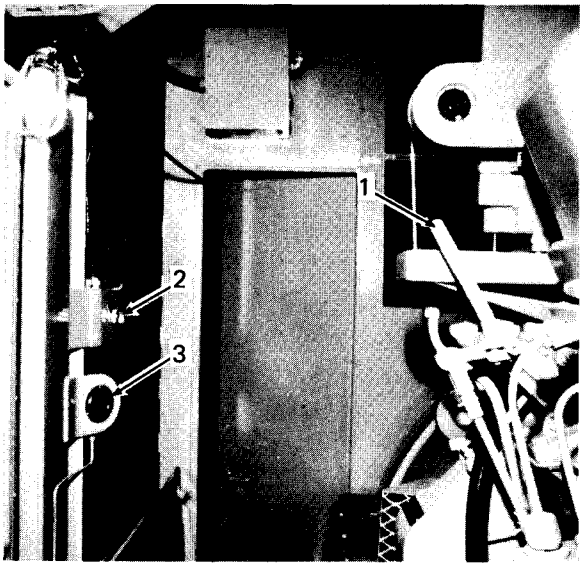
Protect the bell ringer heater and water cooler circuits.

Warning Lights

Refer to SECTION 4. AUTOMATIC ALARMS AND SAFEGUARDS.

Circuit Breakers

Circuit breakers are used in all control circuits and will trip and open whenever an overload occurs. The breakers, located on the control stand and control compartment panel, are suitably identified.



1. Governor layshaft
2. Fuel pump and engine start switch
3. Lube oil pressure gauge

FIGURE 2 - 3
ENGINE START STATION

ENGINE START STATION (Fig. 2-3)

The engine start station is located on the left hand side of the engine compartment, adjacent to the engine governor.

Engine Start Switch

Is a three-position, spring return, rotary switch. Turning the switch to the left will start the fuel pump motor, to the right will crank the engine. The switch automatically returns to centre position when released.

Lubricating Oil Pressure Gauge

The gauge should indicate 40 - 45 psi at idling speed and 80 - 85 psi at the top engine speed.

SPEED INDICATOR

Indicates locomotive speed in miles per hour and is located on the front wall of the operating cab.

CONTROL COMPARTMENT

Battery Switch (BS)

Opening knife switch will cut off all electrical circuits.

Ground Relay Cutout Switch (GRCO)

Refer to SECTION 4, AUTOMATIC ALARMS AND SAFEGUARDS.

Ground Relay Reset Switch (GRS)

Refer to SECTION 4, AUTOMATIC ALARMS AND SAFEGUARDS.

CAB HEATING SYSTEM

The operating cab is heated by a forced air heating system. A three speed fan draws filtered air through a duct containing heating elements. A series of ducts directs the air to the front and sides of the cab. Air flow through the ducts at each side of the cab is regulated by dampers which are manually positioned by means of levers.

The heating elements and fan are controlled by a single switch having four positions as follows:

1. OFF
2. LOW - Low heat and slow fan speed
3. MED - Medium heat and medium fan speed
4. HI - Full heat and fan speed.

NOTE: When the switch is placed to any heating position, the toilet ventilating fan is energized to draw warm air into the toilet area.

HANDBRAKE

The handbrake, located externally at the front of the short hood, mechanically applies the brakes on all wheels of the front truck.

To apply the brake, turn the handwheel in a clockwise direction. To release the brake, turn the wheel counterclockwise.

RADIATOR FAN STOP SWITCHES

Switches are provided to enable the radiator fan to be switched off by operating crew intending to pass through the radiator compartment. Pressing any of these switches will cause a delay relay to de-energize the radiator fan clutch for approximately twenty seconds.

Switch Location

Outside the radiator compartment - a switch is located adjacent to each door.

Inside the radiator compartment - a switch is located on the forward wall.

COMPARTMENT LIGHT SWITCHES

The radiator, engine and generator compartment lights can be controlled by any of four ON/OFF switches, provided at the following locations:

1. Radiator compartment - rear wall

2. Engine compartment - both sides of compartment; in compressor area

3. Operators' cab - switch and circuit breaker panel

MISCELLANEOUS

Toilet and Valet Light Switches

The toilet light switch controls the toilet light and ventilating fan. The valet light switch controls the light in the left hand compartment of the short hood. Both switches are located at the right of the short hood stair well.

Hot Plate Switch

The hot plate with switch is located on the back wall of the cab. The switch has three positions: OFF, LOW, HIGH. When placed in either HIGH or LOW position, a pilot light is illuminated. The switch must be turned OFF when unattended.

SECTION 3

AIR EQUIPMENT

26-LUM BRAKE EQUIPMENT

The locomotive is equipped with 26-LUM brake equipment. The system is designed to meet freight and passenger train requirements, and is suitable for multiple unit operation with locomotives equipped with 26 or 24 type air brake.

26-C BRAKE VALVE (Fig. 3-1)

The 26-C brake valve is a self lapping device which enables the driver to control the locomotive and train brakes. It consists of two principal parts, the automatic brake valve and the independent brake valve.

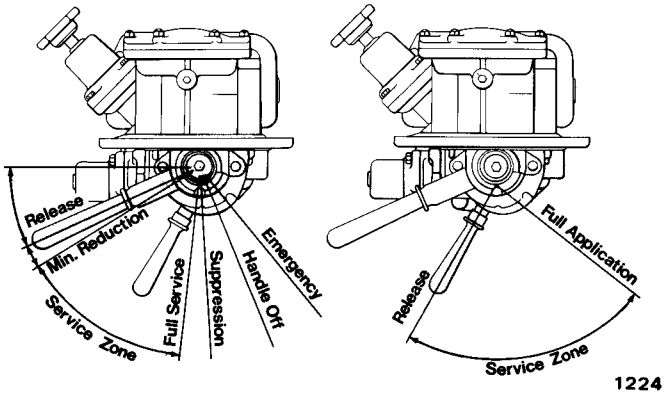
Automatic Brake Valve

The automatic brake valve is a self lapping, pressure maintaining valve which is capable of gradually applying or releasing the brakes.

The valve has six positions which function as follows:

1. RELEASE: This position (extreme left position of the valve handle) is for charging the brake system and for releasing an automatic brake application. Adjustment of the equalizing reservoir pressure in RELEASE position is made by adjusting the knob on rear of valve.

2. MINIMUM REDUCTION position, provides a reduction of approximately 48 kPa(7 psi) in the equalizing reservoir which, in turn, reduces the brake pipe pressure by an equal amount.



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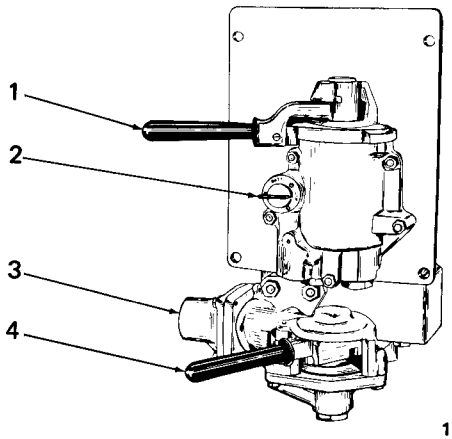

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1. Automatic brake valve handle
2. Automatic brake valve cutoff valve
3. Brake pipe regulating valve
4. Independent brake valve handle

FIGURE 3 - 1
26-C BRAKE VALVE

3. SERVICE: The service position consists of that sector of the handle movement which regulates brake pipe pressure to a lower value than minimum reduction. Intensity of the service brake application is increased as the handle is moved to the right through this sector until a full service reduction has been obtained.

4. SUPPRESSION: This position is used to nullify or suppress a penalty brake application. However, the brake valve is so designed that a full service brake application is obtained whenever the handle is placed in the suppression position.

5. HANDLE OFF: This handle position is used to condition the brake valve on trailing units in M.U. and on units to be hauled DEAD in a train. Brake pipe pressure within the brake valve is reduced to approximately zero and various valves within the brake valve are positioned to make their normal functions inoperative. The handle can be removed from the brake valve when in this position.

6. EMERGENCY: The emergency position is to the extreme right of the brake valve handle In this position the brake pipe pressure is vented to atmosphere at the fastest possible rate to effect an emergency application of the brakes.

Independent Brake Valve

The independent brake valve is a self-lapping type having two positions, RELEASE and APPLICATION.

From the release to the full application position is the application sector and the further the handle is moved to the right, the greater will be the braking effect regardless of the automatic brake valve handle position.

Depression of the handle in the release position will cause the release of any automatic brake application existing on the locomotive. Depression of the handle within the application sector will release the automatic application only to the value corresponding to the position of the handle in the application sector.

AUTOMATIC BRAKE VALVE CUTOFF VALVE

The brake valve cutoff valve is provided for the purpose of cutting in and cutting out the brake valve and to permit measurement of brake pipe leakage. The valve has three positions, as follows:

1. OUT

2. FRT (Freight)

3. PASS (Passenger)

The cutoff valve handle is held in each position by spring pressure, therefore it must be depressed to change position. For normal locomotive operation, as a controlling unit, the handle must be in PASS or FRT. When hauling locomotive DEAD or as a trail unit in M.U., the OUT position is to be used.

MULTIPLE UNIT MU-2A VALVE

The handle has the following positions:

1. LEAD or DEAD

2. TRAIL 24 or 26

The valve is used to set up the locomotive as a leading master or trailing slave unit. When the locomotive is to operate as a leading unit, or to be hauled dead in a train, use LEAD or DEAD. When operating as a

trail unit, the valve must be positioned in TRAIL 24 or 26.

BRAKE PIPE REGULATING VALVE

Regulates the air pressure delivered to the equalizing reservoir. Adjustment is made by turning the knob of the regulator. The automatic brake valve handle must be in RELEASE position while making adjustments.

EMERGENCY BRAKE VALVE

The emergency brake valve is located at the rear of the control stand. When the handle is operated, the brake pipe is opened to atmosphere to effect an emergency brake application.

DEADMAN'S FOOT PEDAL

The deadman's foot pedal controls the safety control system and must be depressed continuously during operation to prevent the system from causing a penalty brake application and returning the engine to idle. If the pedal is released during operation, a warning whistle will sound for approximately six seconds during which time, the pedal must be depressed to prevent a brake application.

The system is inoperative when brake cylinder pressure is 207 kPa (30 psi) or more.

CONTROL AIR SYSTEM

Main reservoir air pressure is reduced to 483 kPa (70 psi) for operating electrical contactors and the reverser. The air pressure is reduced by a regulating valve, equipped with a pressure gauge and adjusting knob. If pressure drops, due to leakage, the contactors

and reverser may not operate. To increase the pressure, turn the adjusting knob clockwise. The pressure regulator and reservoir are located inside the short hood. A condensate drain valve is located below the control air reservoir.

AUXILIARY AIR EQUIPMENT

Locomotive Bell

The bell ringer operating valve is located on the control stand and controls main reservoir air pressure for operating the pneumatic bell ringer.

Locomotive Horn

The control valve for the horn is located on the control stand. To operate the horn, pull and hold the valve. A shutoff cock, located in the control stand controls the air supply to the horn and bell operating valves.

Windshield Wipers

A needle valve, located at each windshield wiper, provides independent control of wiper speed.

Snow Plough Cutoff Cock

The straight air supply, for snow plough service, is controlled by a cutoff cock located at floor level in the back of the control stand.

SANDING CONTROL

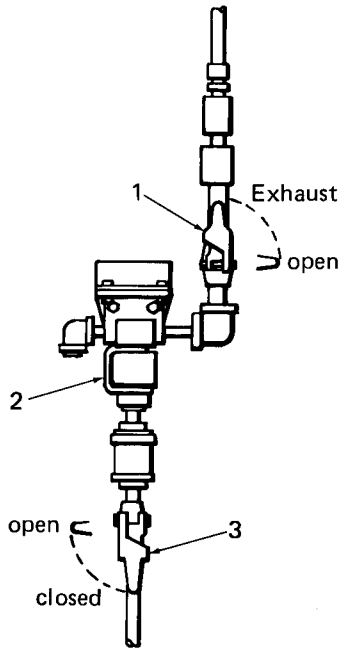
Sand is automatically applied during a wheel slip condition and during an emergency brake application.

The sand is ejected by compressed air controlled by

solenoid operated valves. These valves can also be operated by the operator using the sanding switch on the control stand.

RADIATOR SHUTTERS

Pneumatically operated shutters are provided on both sides of the radiator compartment. The shutters are controlled automatically by water temperature



1. 3-way cock
2. Shutter magnet valve
3. Air supply shutoff cock

FIGURE 3 - 2
RADIATOR SHUTTER CONTROL PIPING

switch T-1. At a predetermined engine temperature, the switch energizes a magnet valve (SMV) which cuts off main reservoir air pressure to, and simultaneously vents the air from, the shutter actuating cylinders. The shutters then move to the open position. Below the predetermined engine temperature the SMV is de-energized and air pressure causes the shutters to close.

A shutoff cock is located before the SMV, and a 3-way cock valve between the SMV and the shutter cylinder supply line (Refer to Fig. 3-2). In the event that the shutters fail to open automatically:

1. Close the shutoff cock to prevent air acting on the cylinders.

2. Position the 3-way cock to exhaust.

3. Observe that the shutters open.

CAUTION: The cooling fan must not be operated with the shutters closed.

SECTION 4

AUTOMATIC ALARMS AND SAFEGUARDS

GENERAL

In single or multiple unit operation, a warning light system is provided for the following.

1. Low lubricating oil pressure
2. Hot engine
3. Low water
4. Ground relay tripped
5. Generator field overload
6. No battery charge
7. Wheel slip
8. Pinion slip
9. Crankcase exhauster not running
10. Ventilation air pressure failure
11. Power off
12. Locomotive overspeed
13. Sanding
14. Excitation field off

Items 1, 2, 3, 4, 5, 6 and 10 - An alarm bell will sound in all cabs and a warning light will operate on the affected unit.

Items 7 and 8 - A buzzer will sound in all cabs and a light will operate on the affected unit.

Items 9, 11, 12 and 14 - A light will operate on the affected unit only.

Item 13 - In lead axle manual sanding a light will operate on the affected unit only. In manual or emergency sanding the light will operate on all units. The light is inoperative when units are operating in reverse direction.

LOW LUBRICATING OIL PRESSURE

In the event of abnormally low lubricating oil pressure, the engine will shut down, the alarm bell will sound and the low lubricating oil pressure warning light will operate.

Proceed as follows:

1. After engine shuts down, turn engine control switch to IDLE. Check engine lubricating oil supply. Check for broken or leaking oil lines.

2. Reset shutdown plunger on govenor to silence the alarm bell.

3. Restart engine in normal manner.

HOT ENGINE

When the engine cooling water temperature reaches 91°C (196°F). The alarm bell will sound and the hot engine warning light will operate.

If the temperature is allowed to drop to 89.4°C (193°F) the alarm will cease. However, an increase of temperature to 95°C (203°F) will cause the engine to return to idle.

LOW WATER

If the level of the engine cooling water in the expansion tank falls below a predetermined level, a float switch will operate the alarm, illuminate the warning light and shut down the engine.

GROUND RELAY TRIPPED

A ground fault in the power circuit operates the ground relay and returns the engine to idle, removes excitation, sounds the alarm bell and illuminates the warning light.

Ground Relay Reset (Fig. 4-1)

The system will reset automatically three times after which the reset button (GRS), located in the control compartment, must be depressed. This permits the automatic reset to function an additional three times.

NOTE: The resetting of the automatic reset may be necessary when attempting to locate and cut out a defective traction motor, but should not be resorted to as a means of bypassing the general function of the ground relay.

Ground Relay Cut Out

If the ground relay continues to trip, proceed as follows:

1. The motor cutout switch may be used to cut out motors. For example: reset ground relay as outlined above; turn motor cutout switch to cut out selected motor and start locomotive. Follow same procedure for all motors.

2. Under extreme emergency conditions, reset ground relay as outlined above, open ground relay cutout switch (Fig. 4-1) in control compartment and move locomotive no farther than is necessary, observing for smoke or overheating of electrical equipment.

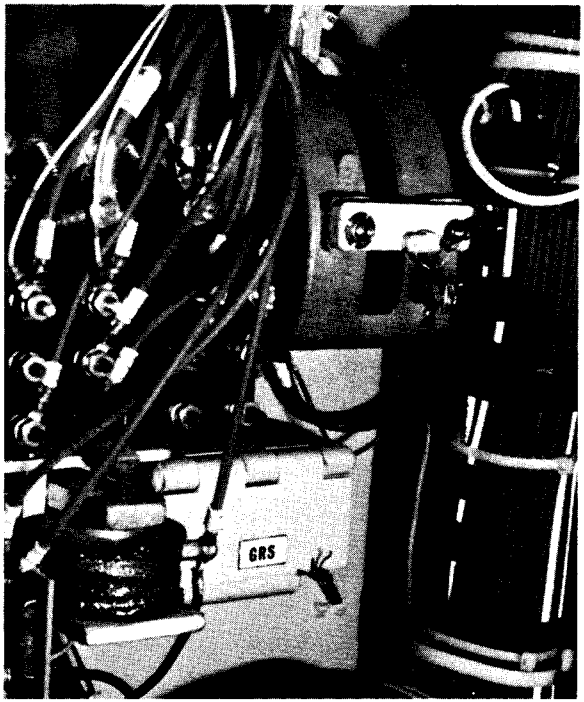


FIGURE 4 - 1
GROUND RELAY CUTOUT SWITCH
AND RELAY RESET SWITCH

The ground relay cutout switch has three positions as follows:

Position 1: Normal operating position.

Position 2: Ground relay and alternator field contactor cutout position. Locomotive cannot operate.

Position 3: Emergency position. Locomotive will operate but without ground relay protection. Seal must be broken to use this position.

3. Repeated ground relay tripping may indicate a traction motor failure which might result in a locked axle. A check should be made to be sure all wheels turn freely.

NOTE: All ground indications should be reported, even if the ground condition appears to have been corrected.

GENERATOR FIELD OVERLOAD RELAY

An overload of the main generator (alternator) field operates a relay to return engine to idle, sound the alarm bell and operate the warning light on the affected unit.

Generator Field Overload Reset

The system will reset automatically three times after which the reset button (GRS), located in the control compartment (Fig. 4-1), must be depressed. This permits the automatic reset to function an additional three times.

NOTE: The resetting of the automatic reset may be necessary when attempting to locate and cut out a defective traction motor, but should not be resorted to as a means of by-passing the general function of the generator field overload relay.

NO BATTERY CHARGE

Indicates a failure in the battery charging system. This feature is inoperative when the Engine Control switch is in IDLE.

In the event of a failure of the battery charging system, the compressor will be unloaded and unable to charge the air system.

WHEEL SLIP

The wheel slip warning light and buzzer operate when the wheel slip system functions. Refer to SECTION 5, "Wheel Slip".

PINION SLIP

If the pinion slip relay operates, the pinion slip light and the wheel slip buzzer will be energized.

In the event that a slip is indicated, the throttle should be returned to IDLE immediately. The affected motor can be cut out with the traction motor cutout switch. Refer to SECTION 2, "Traction Motor Cutout Switch".

CRANKCASE EXHAUSTER

The crankcase exhauster light, should be off continuously, indicating that the exhauster is operating.

If the light is on, check that the crankcase exhauster breaker is closed. If breaker is closed and the exhauster is not running the engine should be shut down and the problem corrected.

VENTILATION AIR PRESSURE FAILURE

If the air pressure in the cooling air duct falls below a preset value, a pressure switch will activate the alarm and warning light circuit, return the engine to idle and remove excitation.

POWER CUTOFF

In the event of a penalty or emergency brake application, a pneumatic control switch (PCS) will operate to return the engine to idle, remove tractive power and illuminate the warning light.

LOCOMOTIVE OVERSPEED

An overspeed condition will cause the locomotive overspeed warning light to operate and warning whistle to sound. The whistle will sound for approximately six seconds; during this period the automatic brake valve handle must be moved to SUPPRESSION to prevent a penalty brake application.

SANDING

The indicating light operates when sand is applied to the leading axle of each truck.

EXCITATION FIELD OFF

If a failure occurs in the traction alternator excitation control circuits, tractive power will be automatically removed and the warning light will operate.

NO WATER FLOW

A flow switch protects the engine from no water flow. If the water stops flowing in the system, the switch will shut down the engine.

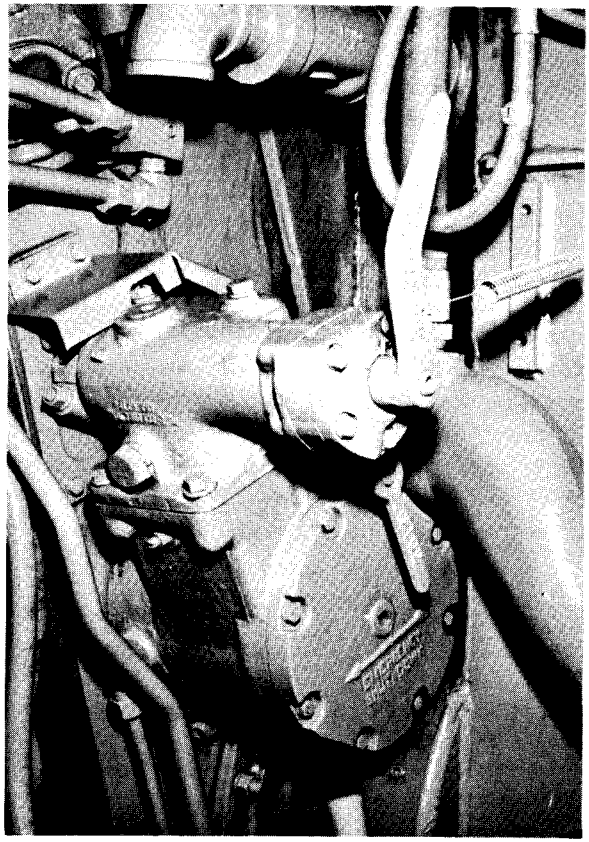


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FIGURE 4 - 2 OVERSPEED TRIP

DIESEL ENGINE OVERSPEED (Fig. 4-2)

If the diesel engine overspeeds the overspeed mechanism, located on the right side of the engine, will operate to shut down the engine. A trip lever releases a spring loaded shaft which in turn rotates the fuel injection pump control shafts to cut off the fuel supply.

The engine can also be shut down by pulling the lever marked STOP at the overspeed mechanism.

In the event of engine overspeed mechanism failure, the engine can be shut down by pulling the manual shutdown plunger on the engine governor.

To reset after an engine overspeed, turn reset handle counterclockwise as indicated by the arrow. Before starting engine, check that plunger is pushed in on the governor.

JOURNAL BOX HEAT INDICATOR

Heat indicators installed in the housing of roller bearing journal boxes emit a pungent odor when journal box temperature reaches 121°C (250°F).

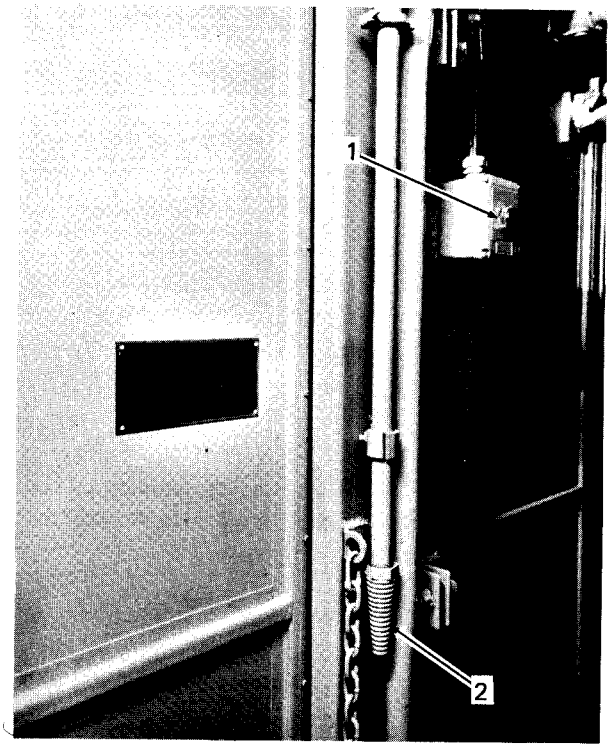
AUTOMATIC WATER DRAIN SYSTEM

A water drain system is provided to automatically drain the cooling system in the event that the water temperature falls to 7°C (45°F) while the engine is shut down. The system is live at all times; regardless of the position of the battery switch. Draining is by means of a solenoid operated dump valve, located in the radiator compartment.

The dump valve is equipped with a momentary contact test switch. To test the servicability of the valve, operate the switch - water should drain, release the switch - water should stop.

A bypass is provided to permit filling of the cooling system with water at 7°C (45°F) or below. The refill switch (Fig. 4-3), when momentarily depressed "locks in" the bypass circuit. The switch is located adjacent to the pressure fill nozzle in the engine compartment.

CAUTION: After using the refill switch to fill the system in cold weather, the engine MUST be started to cause the dump valve bypass system to drop out. Failure to comply will result in loss of automatic water drain system protection.



1. Refill switch
2. Pressure fill connection

FIGURE 4 - 3
REFILL SWITCH

SECTION 5

OPERATION

LOCOMOTIVE EQUIPMENT INSPECTION

Refer to Figure 2 for location of fillers and drains.

Cooling Water System

The locomotive is equipped with a pressurized cooling water system. The system should be filled through the pressure fill nozzle. When filling the system in very cold weather the water refill switch (Fig. 4-3) may have to be operated to bypass the automatic drain system (Refer to SECTION 4 "Automatic Water Drain System). If water under pressure is not available, the system may be filled through the expansion tank filling connection.

A sight glass is located on the cooling system expansion tank. The gauge must show water at all times.

A low water level switch is provided to protect the engine when the water level is too low. To test the system, open the test valve and drain the water from the switch float chamber. The Low Water warning lamp should light, alarm should sound and the engine should shut down.

A manifold, on which are mounted temperature control switches, a temperature gauge and a water sampling valve, is located in the engine compartment (Fig. 5-1). Switches T1 and T2 control the radiator fan eddy current clutch and radiator shutters. Switches ETS1 and ETS2 are engine temperature safety switches. Each switch is equipped with a manual operating plunger to test the operation of the circuits.

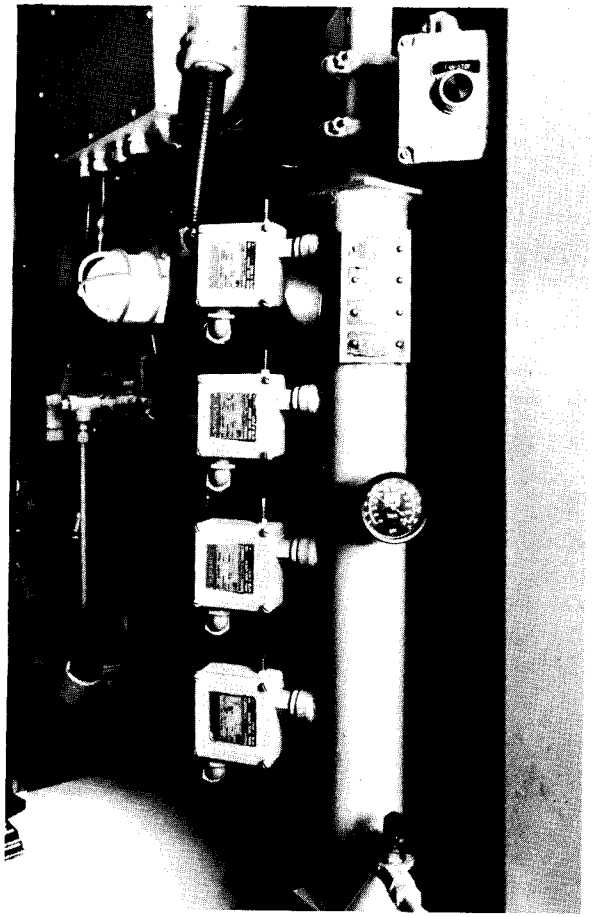


FIGURE 5 - 1
TYPICAL WATER TEMPERATURE SWITCH MANIFOLD

The normal operating temperature of the cooling water may range between 66°C (150°F) and 81°C (180°F).

Tell-tale pipes are provided on the engine at the after-cooler and water pump seal to indicate the presence of leaks in the equipment.

Fuel Oil Level Gauges

Fuel level sight gauges and filling points are provided on both sides of the locomotive.

Lubricating Oil Dipstick

A bayonet gauge is located on the right side of the engine and should show oil between high and low marks, with engine idling and crankcase exhauster off. If oil level is checked with engine shut down the level may be above the high mark.

Air Compressor Oil Level Gauge

Maintain oil level at FULL mark on dip stick while engine is running.

Engine Governor Oil Level

Maintain oil level between lines on sight glass while engine is running.

Traction Alternator Gearbox

Maintain oil level between FULL and ADD marks on dipstick with engine running.

Radiator Fan Gearbox

Maintain oil level to within 8 mm (1/4") of filler hole with engine shut down.

11. Check engine oil level.
12. Check governor oil level.
13. Check generator gearbox oil level.
14. Close all compartment doors.

BEFORE MOVING A TRAIN

Before moving a train, proceed as follows:

1. Move engine control switch to RUN.
2. Check that the traction motor cutout switch is in the ALL IN position.
3. Place automatic brake valve cutout valve to applicable position.
4. Move MU-2A valve to LEAD position.
5. With brake system fully charged, automatic brake valve and independent brake valve in RELEASE position, check air gauge pressure.

   a. Main reservoir . . . . . 115 - 125 psi
   b. Equalizing reservoir . . . . . 70 psi
   c. Brake pipe . . . . . 70 psi
   d. Brake cylinder . . . . . 0 psi

6. Make brake application, release handbrake.
7. Test sanding equipment.
8. Carry out Railway Company brake test.
9. Allow engine to warm up before opening the throttle (40°C/120°F water temperature).

COUPLING UNITS EQUIPPED WITH 26-LUM BRAKE EQUIPMENT

On All Units

1. Engage couplers.

2. Connect air hoses and M.U. jumper cables.
3. Place M.U. headlight setup switch in proper position.

On Leading Unit

1. Position all switches, circuit breakers and valves as for single unit operation.
2. Place MU-2A valve in LEAD position.

On Trailing Units

1. Check that all the circuit breakers on the control compartment panel are closed.
2. Ensure that the main control and engine control circuit breakers and the generator field switch are placed to OFF.
3. Place throttle handle to IDLE.
4. Place reverser handle to OFF and remove.
5. Place automatic brake valve handle in HANDLE OFF position and independent brake valve handle in RELEASE position and remove both handles.
6. Place automatic brake valve cutout valve in the OUT position.
7. Place MU-2A valve in TRAIL position.

MULTIPLE UNIT HOSE CONNECTIONS

When 26-L or 24-RL equipped locomotives are operated in M.U., the following hose connections must be made:

26-L		24-RL
Actuating Pipe	. . . . .	Actuating Pipe
Main Reservoir Equalizing Pipe	. . . . .	Main Reservoir Equalizing Pipe
Brake Cylinder Equalizing Pipe	. . . . .	Ind. Application & Release Pipe

FASTER AIR PUMPING

To rapidly charge a train, it is possible to run the engine faster than idle speed thus driving the compressor at a greater rate.

1. Place generator field switch to OFF.
2. Place reverser handle to OFF.
3. Open throttle as desired up to notch 5.

MOVING A TRAIN

1. Switch ON generator field switch.
2. Move reverser handle into applicable position.
3. Depress deadman's foot pedal.
4. Release brakes.
5. Open throttle (Refer to THROTTLE HANDLING).

STOPPING A TRAIN

Move throttle handle to IDLE position and apply brakes. If leaving operating position, move reverser handle to OFF.

REVERSING A LOCOMOTIVE

1. Bring the locomotive to a full stop.
2. Move reverser handle to opposite direction.
3. Depress deadman's foot pedal.
4. Release brakes.
5. Open throttle.

THROTTLE HANDLING

A feature of these locomotives is that throttle position controls engine horsepower. This allows the operator to control, by throttle notch position, the amount of tractive effort developed.

The proper use of this feature offers much in improved train handling as well as protection of the electrical equipment. It is important, therefore, that the operator thoroughly understand its proper use, since it does require slightly different throttle handling than for other types of locomotives not so equipped.

How It Works

For each throttle position a definite maximum load current and corresponding tractive power are developed. The increase is made immediately but smoothly. Since the total tractive power of the locomotive is divided into eight steps, it is necessary to advance all the way into the 8th notch in order to develop full tractive power. Furthermore, since maximum current is controlled, it is perfectly safe, where electrical or mechanical equipment is concerned, to advance the throttle rapidly into the 8th notch; in fact, this is not only desirable, but necessary under certain starting conditions. Although it is permissible to rapidly advance the throttle, it is good practice to avoid sudden brisk throttle movements.

How It Is Used

The traction motors must not be allowed to stand at a stall condition for any appreciable length of time with load current applied. It is therefore most important, having carefully insured that the brakes are released and that the train is stretched to:

1. Start the locomotive moving as quickly as possible; and
2. Accelerate to a speed which will bring the load-meter pointer down into the green zone in minimum time. Therefore, in making a start, it is good practice to advance the throttle promptly to a notch

that will start locomotive movement. If after starting, acceleration is too fast, or until it is certain that all slack is out, the throttle may be backed off as required to maintain desired locomotive speed. As soon as the slack is out, the throttle may be advanced as fast as desired to suit operating conditions.

Starting Passenger or Light Trains

For normal starting of passenger and light trains, no appreciable difference in throttle handling will be noted from other types of equipment, except the immediate response obtained for each throttle notch advance.

Normal Starting of Heavy Trains

Normally it is not necessary to "bunch" the slack. If the train is known to be stretched, the throttle should be advanced immediately to whatever notch is required to start movement as soon as the brakes are fully released. The throttle should then be advanced or retarded to suit optimum operating conditions, bearing in mind desirability of accelerating the train to where the loadmeter registers in the continuous operating zone in minimum time.

For normal level grade starting, if no movement is obtained when engine has reached its 5th or 6th notch, retard the throttle and check to ensure that the brakes are fully released.

Starting Heavy Trains on Severe Grades

It is occasionally necessary to advance the throttle to the 7th or 8th notch to make a start. The operator must exercise due care in handling the train slack and to time the application of power to coincide with the release of the brakes as much as possible. He should

then have no hesitancy in advancing the throttle quickly into even the 8th notch to get the train moving. While the load current will be high, the control equipment limits it to a value slightly higher than the maximum short time rating shown on the loadmeter. The important thing is to get the locomotive moving and thus keep to a minimum the length of time during which heavy load current is applied to the motors before they start to turn.

WHEEL SLIP

In the event of a wheel slip where one or more pairs of wheels slip up to a higher speed than the others, a detection system automatically operates to correct the slip by immediately reducing power. Power is reapplied as the slip is arrested. If the slip is severe or extended, sand is automatically applied. In the event of repetitive slips manual sanding may be used.

An audio and visual indication is provided if automatic correction does not eliminate the slip within an allotted time when in normal motoring operation. The warning is immediate when coasting because action by the operator may be needed to correct a slide condition to avoid flat spotting the wheels.

If alarm persists, the throttle should be retarded until warning stops. A continuous wheel slip warning may indicate a locked axle. Check to ensure free rotation of all wheels.

BRAKING WITH POWER

To maintain a train in a stretched condition, it is sometimes necessary to keep tractive effort on the locomotive while braking the train. To brake with power:

1. Gradually apply automatic brake for a light brake pipe reduction.
2. Release locomotive brakes by depressing the independent brake valve handle in the RELEASE position.
3. Retard throttle to maintain loadmeter pointer in green band of motoring scale as train speed decreases. Move throttle to IDLE before the train comes to a full stop.

MINIMUM CONTINUOUS SPEED

Whether the locomotive is operating as a single unit or as a multiple unit, loss of rail adhesion at lower speeds normally tends to protect the traction equipment against overload.

In the event that track conditions are such that unusually high adhesion can be maintained, the loadmeter will move into the short time range at 18.7 km/h (11.6 mph).

When operating units with different minimum continuous speeds, the operator must not operate the units continuously below the highest minimum continuous speed of any one unit in multiple.

PASSING OVER RAILWAY CROSSINGS

The severe mechanical shocks received by traction motors when passing over railway crossings at high speed may cause the traction motor brushes to bounce and flashover. At high speeds, reduce throttle to 5th notch or below, while all units pass over the crossing. This is not necessary at low speed.

CHANGING OPERATING ENDS, 26-LUM BRAKE EQUIPMENT

On Unit Being Cut Out

1. Make a 138 kPa (20 psi) brake pipe reduction by moving the automatic brake valve handle to the SERVICE position.
2. Move independent brake valve handle to RELEASE position and observe that the brakes are still applied.
3. Move brake valve cutoff valve to the OUT position.
4. Place the MU-2A valve to the applicable TRAIL 24 or 26 position.
5. Move automatic brake valve handle to the HANDLE OFF position and remove both handles.
6. Place reverser handle in OFF and remove.
7. Place engine control and main control breakers and generator field switch to OFF.

NOTE: On some units equipped for M.U. operation with units of other manufacture, the main control circuit breaker must be left closed until the main control and engine control circuit breakers are closed on unit being cut in.

On Unit Being Cut In

1. Insert reverser handle and leave in OFF.
2. Install automatic and independent brake valve handles.
3. Place the MU-2A valve to the LEAD position.
4. Move brake valve cutoff valve to FRT or PASS depending upon the service intended.
5. Move the independent brake valve handle to FULL APPLICATION position.
6. Place automatic brake valve handle in RELEASE position.
7. Close main control and engine control circuit breakers.
8. Close generator field switch.

9. Release independent brake.
10. Open throttle.

NOTE: Open main control circuit breaker on unit being cut out, if it was left in the closed position as per note in the preceding paragraph.

RECOVERY OF BRAKE AFTER PENALTY APPLICATION

For brake recovery after penalty application, proceed as follows:

1. Place brake valve in SUPPRESSION position.
2. Close throttle to IDLE.
3. Release brakes, after a slight delay of approximately 10 seconds.

SHUTTING DOWN DIESEL ENGINE

Proceed as follows:

1. Open generator field switch.
2. Move engine control switch to IDLE.
3. Press the engine stop button on the control compartment panel.

NOTE: The throttle handle SHUTDOWN position is used for emergency stop only.

4. Apply handbrake.
5. Open all other switches and circuit breakers.
6. Open the battery switch.

SECURING LOCOMOTIVE FOR LAYOVER

Proceed as follows:

1. Shut down diesel engine.
2. Place reverser handle to OFF. Remove handle.
3. Apply handbrake.
4. Remove automatic and independent brake valve handles.
5. Open all switches and circuit breakers.
6. Open main battery switch.
7. Close and secure all windows and doors.
8. Cover the exhaust stack if the locomotive is to be exposed to inclement weather.

COLD WEATHER PRECAUTIONS

When freezing weather is anticipated, extra precautions must be taken to see that water in the locomotive does not freeze when the engine is shut down. If heating facilities are not available, all water and condensation must be drained from systems as follows:

1. Engine cooling system.
2. Air system
   a) Main reservoir.
   b) Control air reservoir.
   c) Air filters and strainers.
   d) Air cooling manifold.
3. Toilet
4. Remove water bottles from refrigerator.

M.U. EMERGENCY SHUTDOWN

The SHUTDOWN position of the throttle handle is used for emergency shut down of engines. When the handle is moved to SHUTDOWN, it will stop the

engine of the unit and simultaneously all other engines of a multiple unit locomotive. It is provided for emergency use only. Normal shut down should be made with the engine stop button on the control compartment panel.

To restart engines of a single or multiple unit locomotive after emergency shut down:

1. Move the throttle handle to IDLE on controlling unit.
2. Place the engine control switch to IDLE on all units and start engines in normal manner.

EMERGENCY FUEL CUTOFF

Two emergency fuel cutoff switches, one on each side of the locomotive, are provided for emergency fuel cut off. Momentarily pressing either switch will stop the fuel pump and shut down the engine. The emergency fuel cut off on the control compartment panel in the cab is the engine stop button.

The engine start switch must be turned to the RESET and START F.P. position before restarting the engine.

REVERSER EMERGENCY OPERATION

WARNING: High voltage present in control compartment. Before opening compartment doors, turn engine control switch to IDLE. Excercise caution, as control voltage is present.

If the reverser fails to operate, turn Engine Control Switch to IDLE on the affected unit. Try throwing the reverser by pressing the magnet valve solenoid located on the reverser. Check direction by slight application of power with brakes applied.

If this is not effective, remove manual operating handle from bracket in the control compartment. Insert handle in hole provided in operating lever on top of operating shaft and move reverser in direction desired.

TAKING A UNIT OUT OF SERVICE IN M.U. OPERATION

Turn the engine control switch to IDLE position. If it becomes necessary to stop the engine, press the engine STOP button and open the fuel pump and crankcase exhauster circuit breakers. Refer to "Towing Dead Locomotive."

PLACING UNIT IN SERVICE IN M.U. OPERATION

If the engine has been shut down, start in usual manner. It is desirable to allow an engine which has been shut down to attain operating temperature before applying load. When engine is warmed up, turn engine control switch to the RUN position.

NOTE: If it is necessary to start the engine of the lead unit while train is under way, move throttle to IDLE. The throttle may be advanced as soon as engine is started.

OPERATING WITH LEAD UNIT IDLING OR SHUT DOWN

To operate with lead unit idling:

1. Turn engine control switch to IDLE.
2. Operate in usual manner. However, the loadmeter will be inoperative.

To operate with lead unit shut down:

1. Turn engine control switch on lead unit to IDLE.
2. Close positive and negative battery and MCBX and ECBX circuit breaker.
3. Open all other circuit breakers on switch and circuit breaker panel except those required for operation.
4. Close main control breaker, engine control breaker and generator field switch on lead unit.

NOTE: With engine shut down, battery charging generator ceases to function. The battery voltage will weaken enough in a few hours to prevent further locomotive operation. In all cases, conditions in trailing units are the same as normal.

OPERATING WITH DEAD BATTERY ON LEAD OR TRAILING UNIT

On Lead Unit:

1. Turn engine control switch to IDLE.
2. Open battery breakers.
3. Open all circuit breakers on switch and circuit panel except those required for operation.
4. Close engine control breaker and close generator field switch and main control breaker on the control stand.

On Any One Trailing Unit:

Ensure that all circuit breakers on switch and circuit breaker panel are closed.

TOWING DEAD LOCOMOTIVE

In freezing weather, drain engine water system.

Brake equipment on one or more dead units, which are in multiple with a live leading unit, should be set up the same as live trailing units.

It is recommended that brake equipment on a dead locomotive, which is not in multiple with a live unit, should be set up as a single dead unit as follows:

1. Drain all air from main reservoirs and air brake system.
2. Move automatic brake valve cutoff valve to OUT position and MU-2A to LEAD or DEAD position.
3. Place automatic brake valve handle in HANDLE OFF position and independent brake valve handle in RELEASE position.
4. Place throttle handle in IDLE and reverser handle in OFF position. Remove reverser handle.
5. Place dead engine cock (Fig. 5-2) in open (dead) position.

NOTE: The dead engine cock is located on the brake equipment rack, beneath the operating cab, on the right side of the locomotive.

6. Release cap on control valve should be in DIRECT RELEASE position.
7. Connect brake pipe hose.

OPERATING THROUGH WATER

Do not exceed 5 km/h (3 mph) if there is water above the railhead. Do not pass through water over 10 cm (4 in.) above the railhead.

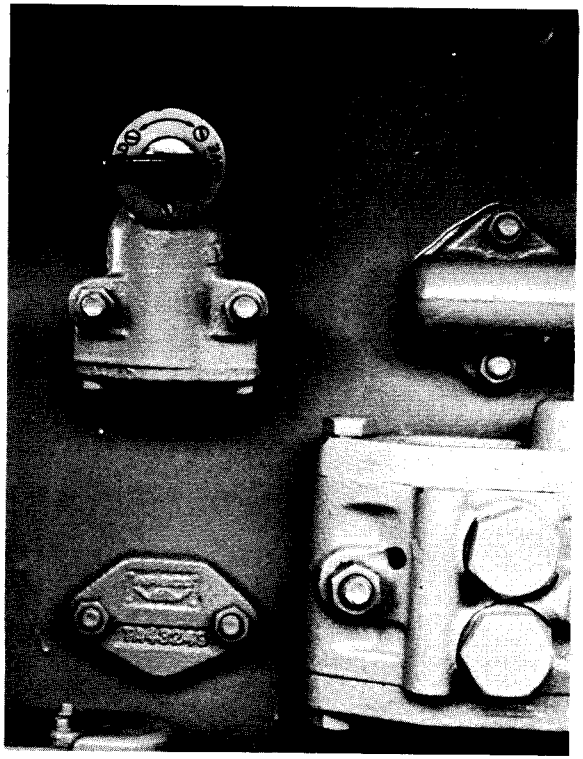


FIGURE 5 - 2 DEAD ENGINE COCK

SECTION 6

MISCELLANEOUS

BATTERY CHARGING

The locomotive is equipped with an external power receptacle to allow charging of the batteries from a 75 VDC power source. The receptacle is located on the left side of the locomotive, behind the cab, at frame level.

FIRE EXTINGUISHERS

Two dry-chemical fire extinguishers are installed on the locomotive, one in the cab and the other in the right hand side of the engine compartment.

PORTABLE LIGHT RECEPTACLES

Receptacles are provided in the cab, and engine compartment for 75 VDC portable inspection lamps.

M.U. JUMPER CABLE

An electrical jumper cable is provided for M.U. operation. When not in use, the cable is stowed in the front compartment of the short hood.

FLAGMAN'S KIT

A stowage container for the flagman's kit is located on the back of the control stand.

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